

CENTER FOR BEAM PHYSICS SPECIAL SEMINAR

“High Performance Simulation of Intense Beams: Algorithms and Applications”

Ji Qiang, LANL

Tuesday, August 21, 2001, 9:00 AM

Director's Conference Rm., bldg. 50A-5132, LBNL

*** note special day/time/venue ***

Summary:

Self-consistent simulation of intense beams has important applications in modern accelerators. This usually requires solving the Poisson-Vlasov equations or the Poisson-Fokker-Planck equations in the six dimensional phase space. In this talk we will report on the solution of these equations using parallel particle-in-cell methods on high performance computers. We will discuss the development of algorithms for solving the 3D Poisson equation subject to different boundary conditions, and the development of a second-order stochastic integrator for the Langevin equation associated with a Fokker-Planck simulation. We will also discuss the issue of implementing parallel Poisson-Vlasov and Fokker-Planck codes on multi-processor computers so that these codes, which involve a significant amount of inter-processor communication, achieve high performance. Applications will be presented showing beam dynamics studies in the Spallation Neutron Source (SNS) linac and the LANL Low Energy Demonstration Accelerator (LEDA) beam halo experiment.

Biographical data and research interests:

Ji Qiang received his Ph. D. degree in January 1998 from the University of Illinois at Urbana-Champaign, where he performed plasma transport modeling related to the ITER tokamak project. After graduation, he joined Los Alamos National Laboratory as a postdoctoral research associate and then as a limited term technical staff member working in the field of computational accelerator physics. Dr. Qiang has developed parallel codes and algorithms that have been applied to the SNS, APT, and LEDA projects, to modeling halo formation in high intensity beams, to modeling the strong-strong beam-beam interaction, and to modeling stochastic dynamical systems. His research interests include developing numerical algorithms for studying many-body systems, parallel computing, object-oriented software design, and applying computational tools to studying beam dynamics in accelerators.